

ADVANCED PLACEMENT PHYSICS B EQUATIONS FOR 2010 and 2011

NEWTONIAN MECHANICS

$v = v_0 + at$ $x = x_0 + v_0 t + \frac{1}{2}at^2$ $v^2 = v_0^2 + 2a(x - x_0)$ $\Sigma \mathbf{F} = \mathbf{F}_{net} = m\mathbf{a}$ $F_{fric} \leq \mu N$ $a_c = \frac{v^2}{r}$ $\tau = rF \sin \theta$ $\mathbf{p} = m\mathbf{v}$ $\mathbf{J} = \mathbf{F}\Delta t = \Delta \mathbf{p}$ $K = \frac{1}{2}mv^2$ $\Delta U_g = mgh$ $W = F\Delta r \cos \theta$ $P_{avg} = \frac{W}{\Delta t}$ $P = Fv \cos \theta$ $\mathbf{F}_s = -k\mathbf{x}$ $U_s = \frac{1}{2}kx^2$ $T_s = 2\pi\sqrt{\frac{m}{k}}$ $T_p = 2\pi\sqrt{\frac{\ell}{g}}$ $T = \frac{1}{f}$ $F_G = -\frac{Gm_1m_2}{r^2}$ $U_G = -\frac{Gm_1m_2}{r}$	$a = \text{acceleration}$ $F = \text{force}$ $f = \text{frequency}$ $h = \text{height}$ $J = \text{impulse}$ $K = \text{kinetic energy}$ $k = \text{spring constant}$ $\ell = \text{length}$ $m = \text{mass}$ $N = \text{normal force}$ $P = \text{power}$ $p = \text{momentum}$ $r = \text{radius or distance}$ $T = \text{period}$ $t = \text{time}$ $U = \text{potential energy}$ $v = \text{velocity or speed}$ $W = \text{work done on a system}$ $x = \text{position}$ $\mu = \text{coefficient of friction}$ $\theta = \text{angle}$ $\tau = \text{torque}$
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ELECTRICITY AND MAGNETISM

$F = \frac{1}{4\pi\epsilon_0} \frac{q_1q_2}{r^2}$ $\mathbf{E} = \frac{\mathbf{F}}{q}$ $U_E = qV = \frac{1}{4\pi\epsilon_0} \frac{q_1q_2}{r}$ $E_{avg} = -\frac{V}{d}$ $V = \frac{1}{4\pi\epsilon_0} \sum_i \frac{q_i}{r_i}$ $C = \frac{Q}{V}$ $C = \frac{\epsilon_0 A}{d}$ $U_c = \frac{1}{2}QV = \frac{1}{2}CV^2$ $I_{avg} = \frac{\Delta Q}{\Delta t}$ $R = \frac{\rho \ell}{A}$ $V = IR$ $P = IV$ $C_p = \sum_i C_i$ $\frac{1}{C_s} = \sum_i \frac{1}{C_i}$ $R_s = \sum_i R_i$ $\frac{1}{R_p} = \sum_i \frac{1}{R_i}$ $F_B = qvB \sin \theta$ $F_B = BI\ell \sin \theta$ $B = \frac{\mu_0}{2\pi} \frac{I}{r}$ $\phi_m = BA \cos \theta$ $\mathcal{E}_{avg} = -\frac{\Delta \phi_m}{\Delta t}$ $\mathcal{E} = B\ell v$	$A = \text{area}$ $B = \text{magnetic field}$ $C = \text{capacitance}$ $d = \text{distance}$ $E = \text{electric field}$ $\mathcal{E} = \text{emf}$ $F = \text{force}$ $I = \text{current}$ $\ell = \text{length}$ $P = \text{power}$ $Q = \text{charge}$ $q = \text{point charge}$ $R = \text{resistance}$ $r = \text{distance}$ $t = \text{time}$ $U = \text{potential (stored) energy}$ $V = \text{electric potential or potential difference}$ $v = \text{velocity or speed}$ $\rho = \text{resistivity}$ $\theta = \text{angle}$ $\phi_m = \text{magnetic flux}$
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FLUID MECHANICS AND THERMAL PHYSICS

$\rho = m/V$ $P = P_0 + \rho gh$ $F_{buoy} = \rho Vg$ $A_1 v_1 = A_2 v_2$ $P + \rho gy + \frac{1}{2} \rho v^2 = \text{const.}$ $\Delta \ell = \alpha \ell_0 \Delta T$ $H = \frac{kA \Delta T}{L}$ $P = \frac{F}{A}$ $PV = nRT = Nk_B T$ $K_{avg} = \frac{3}{2} k_B T$ $v_{rms} = \sqrt{\frac{3RT}{M}} = \sqrt{\frac{3k_B T}{\mu}}$ $W = -P \Delta V$ $\Delta U = Q + W$ $e = \left \frac{W}{Q_H} \right $ $e_c = \frac{T_H - T_C}{T_H}$	$A = \text{area}$ $e = \text{efficiency}$ $F = \text{force}$ $h = \text{depth}$ $H = \text{rate of heat transfer}$ $k = \text{thermal conductivity}$ $K_{avg} = \text{average molecular kinetic energy}$ $\ell = \text{length}$ $L = \text{thickness}$ $m = \text{mass}$ $M = \text{molar mass}$ $n = \text{number of moles}$ $N = \text{number of molecules}$ $P = \text{pressure}$ $Q = \text{heat transferred to a system}$ $T = \text{temperature}$ $U = \text{internal energy}$ $V = \text{volume}$ $v = \text{velocity or speed}$ $v_{rms} = \text{root-mean-square velocity}$ $W = \text{work done on a system}$ $y = \text{height}$ $\alpha = \text{coefficient of linear expansion}$ $\mu = \text{mass of molecule}$ $\rho = \text{density}$
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ATOMIC AND NUCLEAR PHYSICS

$E = hf = pc$ $K_{\max} = hf - \phi$ $\lambda = \frac{h}{p}$ $\Delta E = (\Delta m) c^2$	$E = \text{energy}$ $f = \text{frequency}$ $K = \text{kinetic energy}$ $m = \text{mass}$ $p = \text{momentum}$ $\lambda = \text{wavelength}$ $\phi = \text{work function}$
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WAVES AND OPTICS

$v = f\lambda$ $n = \frac{c}{v}$ $n_1 \sin \theta_1 = n_2 \sin \theta_2$ $\sin \theta_c = \frac{n_2}{n_1}$ $\frac{1}{s_i} + \frac{1}{s_o} = \frac{1}{f}$ $M = \frac{h_i}{h_o} = -\frac{s_i}{s_o}$ $f = \frac{R}{2}$ $d \sin \theta = m\lambda$ $x_m \approx \frac{m\lambda L}{d}$	$d = \text{separation}$ $f = \text{frequency or focal length}$ $h = \text{height}$ $L = \text{distance}$ $M = \text{magnification}$ $m = \text{an integer}$ $n = \text{index of refraction}$ $R = \text{radius of curvature}$ $s = \text{distance}$ $v = \text{speed}$ $x = \text{position}$ $\lambda = \text{wavelength}$ $\theta = \text{angle}$
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GEOMETRY AND TRIGONOMETRY

<p>Rectangle $A = bh$</p> <p>Triangle $A = \frac{1}{2}bh$</p> <p>Circle $A = \pi r^2$ $C = 2\pi r$</p> <p>Parallelepiped $V = \ell wh$</p> <p>Cylinder $V = \pi r^2 \ell$ $S = 2\pi r \ell + 2\pi r^2$</p> <p>Sphere $V = \frac{4}{3} \pi r^3$ $S = 4\pi r^2$</p> <p>Right Triangle $a^2 + b^2 = c^2$ $\sin \theta = \frac{a}{c}$ $\cos \theta = \frac{b}{c}$ $\tan \theta = \frac{a}{b}$</p>	$A = \text{area}$ $C = \text{circumference}$ $V = \text{volume}$ $S = \text{surface area}$ $b = \text{base}$ $h = \text{height}$ $\ell = \text{length}$ $w = \text{width}$ $r = \text{radius}$
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